UNIVERSITY OF WASHINGTON

ARBORETUM BULLETIN

Published Quarterly by the Arboretum Foundation

FALL, 1973

PRESIDENT'S MESSAGE

Sometimes the true value which citizens place upon cultural assets is recognised by the outpouring of sentiments following a tragedy. The response to the destruction of the Japanese Tea House earlier this year is an example that has been gratifying indeed.

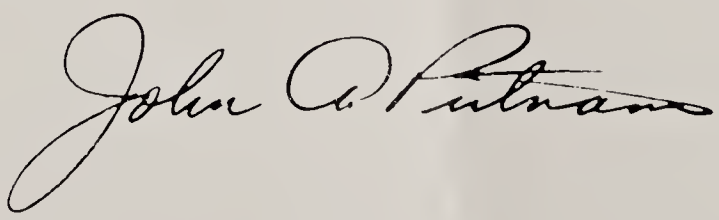
Immediate efforts were made to assess the loss and offers of cooperation and financial assistance came from many quarters: members of the Prentice Bloedel Unit 86, the Japanese Garden Unit; Mr. Bill Yorozu and members of the Japanese Gardeners Association; Mr. Bob Edwards, Chairman of the Seattle-Kobe Affiliation; and countless friends of the Arboretum.

In a letter to Mayor Uhlman, former Mayor Gordon Clinton, president of the Japanese-American Society pledged the support and cooperation of that organization in efforts to rebuild an equally authentic structure. A special ordinance prepared for and signed by Mayor Uhlman called for restoration and adequate fund-raising to accomplish the project, Mr. Clinton being named Chairman for that activity.

A letter signed by your President and Mr. Ken Sorrells was directed to Mr. K. Yamado, Head of the Kobe Trade Information Office in Seattle, transmitting plans and specifications and requesting they be submitted to the proper authorities in Japan for bids for replacement of the original structure.

At this date, formalized plans await the signing of the new lease for the Arboretum.

To name all members of the Foundation who have given unstintingly of their time and talents to the Arboretum would be impossible! Two examples, however, serve to illustrate the dedication of all. Mrs. Arthur Gardiner, Chairman of the Fall Bulb Sale, not only completely inundated herself and her committee with bulbs large and small and realized a profit for the Foundation of $3200.00 but won eighteen new members of the Foundation and many new friends for the Arboretum for good measure! Mrs. Allen B. Engle has demonstrated her interest and dedication to the Arboretum by personally selling eighteen copies of THE LONG ROAD TRAVELLED! Our special commendations to all of our hard-working members for their devotion and dedication.



THE ARBORETUM BULLETIN

Vol. XXXVI, No. 3
Seattle, Wa., Fall, 1973

OFFICERS

John A. Putnam
President
Giacomo Pirzio-Biroli, M.D.
Vice-President
Mrs. Gordon D. Logan
Vice-President
Prentice Bloedel
Vice-President
Phyllis Cavender
Vice-President
Mrs. John S. Robinson
Secretary
N. Stewart Rogers
Treasurer
Mrs. Marilyn Holm
Executive Secretary

BULLETIN EDITORIAL BOARD

Gordon D. Marckworth
Editor Emeritus

Mrs. Joseph P. Butler
Editor
Mrs. Hugh Baird
Mrs. Robert Berry
Mrs. Allen B. Engle
Mrs. Percy Guy
B. J. D. Meeuse
Brian O. Mulligan
R. F. Stettler

HONORARY

Joseph A. Witt

The ARBORETUM BULLETIN is a journal of general horticultural information published quarterly, as a bonus of membership, by the University of Washington ARBORETUM FOUNDATION, a non-profit organization to further the development of the University of Washington Arboretum. Information regarding membership in the Foundation may be obtained by writing to the ARBORETUM FOUNDATION, University of Washington, 98195 or by calling 325-4510. Articles on botany and horticulturally related subjects written by professional and amateur botanists, horticulturists, educators and gardeners are welcomed. No part of this BULLETIN may be reprinted without the authority of the ARBORETUM FOUNDATION.

Rhododendron yakusimanum — Leslie Greenwood

* This is printed on an actual "Rhodo" note card.

Lithographed Rhododendron Originals

watercolors by **Leslie Greenwood**

ILLUSTRATOR Leslie Greenwood, of Watlington, Oxford, England, has done a superb job of painting these exclusive prints and notes. Live specimens of Rhododendron yakusimanum and Rhododendron 'Crest' were used to ensure complete accuracy and authenticity. Mr. Greenwood has received many awards for illustrations from the Royal Horticulture Society. He illustrated the book "Flowers of the World" which has recently been released.

THE UNIVERSITY OF WASHINGTON
Arboretum bulletin

VOLUME XXXVI, NUMBER 3
Fall, 1973

TABLE OF CONTENTS

President's Letter ..... John A. Putnam — Inside Front Cover

A *Busman's Holiday* in Europe:
Flowers and Gardens in the Spring ..... Brian O. Mulligan — 2

Seeds and Fruits and Their
Dispersal Strategies ..... B.J.D. Meeuse — 11

Arboretum Classes 18

New Members 18

Arboretum Spotlight —
Sarcococca hookeriana var. *digyna* ..... J. A. Witt — 19

What's *Bugging* Your Plant? ..... Sharon Collman — 22

An Herbarium for the Arboretum ..... Joy M. Spurr — 24

Unit Conversations ..... Phyllis Morgan — 27

Book Reviews 28

Cover PHOTO: Asclepias fruit and seed
Photo: Sigurd Olsen

Beech trees along drive to Powerscourt House, Enniskerry, Co. Wicklow, Ireland. May 2, 1973

A *Busman's Holiday* in Europe

Flowers and Gardens in the Spring

*BRIAN O. MULLIGAN**

Having retired from the Arboretum at the end of June, 1972, a spring vacation in Europe, which Mrs. Mulligan and I had been unable to take previously because of the press of work at that busy season, became a distinct possibility.

Thus in October we began to draw up a program and to make contacts at some of the places which we particularly wanted to visit. These included the Burren area in Co. Clare, southwest Ireland; the nursery of Jack Drake (now owned by John Lawson) near Aviemore in northern Scotland, and the famous Inverewe garden not far away on the northwest coast. Also in Scotland, we wished to pay another visit to Euan and Peter Cox near Perth and see the nursery which the latter had established in recent years. In Wales, we wanted to return once again to Bodnant, near Conway, one of the most beautiful and interesting gardens in the British Isles, followed by a visit on the outskirts of Birmingham to Roy Elliott, a skilled cultivator of alpine plants and editor of the Alpine Garden Society's *Quarterly Bulletin*. From there Westonbirt Arboretum in Gloucestershire was only a short drive and certainly had to be included on the tour, as well as the University Botanic Garden at Oxford, with which the Arboretum had been exchanging seeds for many years.

A week with friends in the London area would permit us to visit the Royal Horticul-

*Mr. Mulligan, retired Director of the Arboretum, shares his trip with our readers in this first of a three-part article. All photos are his.

tural Society's Garden at Wisley in Surrey, the Savill Gardens at Windsor, and also attend the great spring show of the R.H.S. at Chelsea in London during the week of May 21-25. Following this a visit to western England would allow us to see several well-known gardens in Devon and Cornwall as well as to spend time with relatives in the latter county.

This portion of our trip would occupy about five weeks and essential to its success was adequate transportation. Hence through our travel agent in Seattle, we arranged in advance to hire a car as soon as we arrived in the several countries.

Returning from Cornwall to London we would then fly to Rotterdam to spend a few days with our friends Mr. and Mrs. van Hoey Smith at the remarkable Trompenburg

Arboretum in that city. Thence we would go into Belgium to pay a similar visit to the de Belder Arboretum at Kalmthout, between Antwerp and the Dutch border, and also to see their newer and larger one, Hemelrijk, being established at Essen a few miles to the north.

From Kalmthout we would go to Brussels by train, then on to Paris by the same means to stay with our old friends Prof. and Mme. Georges Morel near Versailles. Some local visits could be arranged from there, including, I hoped, one to the French National Arboretum des Barres, some 90 miles to the south, which I had last seen in 1960, and to the world-famous rose garden at Bagatelle, close to Paris.

An earlier invitation to stay at a small town in the French Alps was accepted for a week—a friend by correspondence at the Institut de Botanique of the University of Grenoble generously offered us his home in Pralognan-la-Vanoise during June. From Grenoble it would be easy to reach Geneva by train, where we could visit the internationally known Botanic Garden belonging to that city, another institution with which the Arboretum here has exchanged seeds over a long period and one which is a particularly good source for seeds of native alpine plants. Finally we would continue into southwest Germany and pay a visit to former member of the Arboretum staff and his wife, now retired and living in a Black Forest village near Freiburg.

Thus with the help of our capable travel agent and the goodwill of our many friends in these various countries we were able to draw up a detailed program which would occupy ten weeks from April 25 to July 4 and take us through eight countries at a most pleasant time of the year to see plants.

We departed from Seattle at 9:00 A.M. for New York, changed to an Aer Lingus plane and arrived in Shannon, Ireland at 9:40 A.M. the next morning in fine weather. We picked up our first of several cars and drove some 35 miles northwest to the small town of Lisdoonvarna, near the coast of Clare, where we were to stay for two nights at Keane's Hotel. Mrs. Keane is an authoritative source of information on the flora of the area. En route from the airport we had noticed primroses in flower along the roadside and during a short walk before dinner discovered more native plants in bloom along the hedgerows, including two shrubby species of willows *(Salix aurita* and *S. repens)*, the dog violet *(Viola canina)*, the whin (gorse in England) *(Ulex europaeus)*, plus three species of ferns on banks or stone walls.

Next morning we first drove south about ten miles to see the famous cliffs of Moher, about 600 feet high, then returned north to the road close to the coast through the Burren, an area of about 100 square miles of limestone hills and terraces. The flora includes both mountain as well as maritime plants; we saw in flower *Gentiana verna, Dryas octopetala* (just opening) forming tight mats, sea pinks *(Armeria maritima)*, the purple orchis *(Orchis mascula)*, and in deep crevices of the limestone pavement the rare fern *Asplenium marinum*, besides the more common Hart's tongue fern *(Phyllitis scolo-*

***Daphne pontica* in flower at Birr Castle, Co. Offaly, Ireland, April 30, 1973**

Powerscourt House, Co. Wicklow, Ireland, from lake, showing terraces. May 2, 1973

pendrium). We enjoyed a picnic lunch on a bank above the road sitting amongst the *Dryas* and scattered gentians absorbing a marine view which extended west to the Aran Islands and northwest across Galway Bay to Connemara. The birds were nearly as interesting as the flowers: at the cliffs hooded crows and a sparrow hawk with its prey, at the Burren skylarks were heard but not seen, as well as a cuckoo, and a flock of young plovers on the wing. Returning over the hill road to Corofin we found and photographed more of the gentians and violets flowering in the rough grass among the rocks, although nowhere in great quantities.

We departed with regret the next morning from Lisdoonvarna and its remarkable flora and followed the road near the coast some 34 miles into Galway city situated at the head of Galway Bay and astride the river Corrib. From here we headed west towards Connemara and the town of Clifden, again following a minor road near the coast as far as possible, then turning north over moorland dotted with numerous small lakes. We were seeking both *Daboecia cantabrica* and *Erica erigena* (formerly *E. mediterranea*), two members of the heath family which are found in this part of Ireland. We were successful with the former, even though it was not in flower and grew amongst *Calluna vulgaris, Erica cinerea, E. Tetralix* and other plants enjoying these acid conditions. The *Erica*, however, eluded us, although it should have been flowering at this season. The dominant shrub was the dwarf whin, *Ulex nanus*, a species which blooms in autumn and not in spring.

Passing through Roundstone en route, which is evidently a place of summer houses, we noted flourishing plants of New Zealand flax *(Phormium tenax), Cordyline australis, Fuchsia magellanica*, with species of *Hebe* and *Senecio*, indicating the mild, maritime climate appreciated by these inhabitants of the southern hemisphere. Just ouside Clifden we found five species of ferns growing on a shady wall, another indicator of the local climatic conditions.

Leaving Clifden next morning we followed the main road towards Westport in Co. Mayo, traversing a peat bog in active use and finding hedges of the *Fuchsia* in many places, as at Kylemore and Leenaun; the evergreen shrubby honeysuckle, *Lonicera nitida*, was also frequently used for the same purpose. At Kylemore *Rhododendron ponticum* has run wild and grows 15–20 ft. tall along the roadside.

Regrettably we had no time to explore this delightful country more fully, but turned eastwards again at the latter place to return to Galway via the narrow isthmus between Loughs Mask and Corrib, through Cong. Some twenty miles south of Galway and just north of Gort we diverged from the main road to visit the former home of poet W. B. Yeats, at Thoor Ballylee, a 16th century rectangular tower now maintained as a memorial and museum to him.

Crossing the Slieve Aughty Mountains on our way to Portumna and Birr we noticed successful plantings by the State Department of Forestry of lodgepole pines, with some larch, Sitka spruce, and older Scots pines. We reached Birr late in the afternoon,

***Rhododendron edgeworthii* flowering in garden of Mr. J. E. Gibson, Rhu, Dunbartonshire, Scotland. May 3, 1973**

to find all the roads around this small town lined with the cars of spectators at an important local hurling game, which in Ireland is somewhat akin to field hockey. In addition to this major attraction one of the candidates for the forthcoming election for a new President of the Irish Republic was due to speak in the town square that evening! Fortunately we had a reservation for a room at the principal hotel or we might not have had dinner or a bed there. Showers of wet snow or sleet however cancelled the expected speech.

Next morning, which was fortunately dry although cold, we visited Birr Castle, residence of the Earl and Countess of Rosse, which we had last seen in October, 1970. This spring was later and colder than usual in Ireland (and also in Scotland, as we discovered later) and many trees and shrubs were flowering late or had their blooms spoiled by frosts in April, for example, many of the magnolias, of which there is an exceptionally large collection here, *M. stellata* and the hybrid *M.x loebneri* were flowering well. We were surprised to see the evergreen *M. delavayi* flourishing against a wall; other unexpected successes were the Chilean *Drimys winteri, Hoheria lanceolata* and several species of *Corokia* from New Zealand, with the parrot's beak *(Clianthus puniceus)* and *Crinodendron hookerianum* from Chile with pendulous red flowers, trained to the wall of the castle. Two other shrubs now in full bloom were *Daphne pontica* from western Asia, having clusters of greenish-yellow flowers, and the beautiful *Berberis linearifolia*, native of southern Chile, the flowers orange tinged red on the outside of the petal.

A very wide selection of choice and rare trees and shrubs is grown here, the result of many years of careful choice and placing of the best material. Conifers, especially firs and spruces of Chinese origin, and maples are especially numerous and varied, many of them having been raised from seeds received from collectors. A most conspicuous small tree was *Aesculus neglecta* var. *erythroblastos*, bedecked with bright rose-red young foliage; this is of German nursery origin in the early 1930s. Ancient hedges of common box now form an allee some 35 feet in height, while others of pleached hornbeams *(Carpinus betulus)* are to be found in an adjacent formal garden. Birr Castle certainly has much of interest for any season.

From there we drove southeast through Kilkenny to New Ross, Co. Wexford, where we stayed two nights in order to pay another visit to the nearby J. F. Kennedy Arboretum, supported by the Irish Republic government; this we had also last seen in 1970 when it was in early stages of planting. The Director, Dr. J. Durand, with Mr. Owen Mooney, Senior Inspector of the Department of Lands in Dublin, accompanied us round the Arboretum.

This covers some 270 acres, plus about 140 acres of forest plots of varying sizes, all situated on the side of a hill exposed to the prevailing southwesterly winds blowing up the estuary of the river Barrow. Screens made of plastic netting are used to protect young plants such as Japanese maples which are particularly susceptible to wind damage in the spring. Shelter belts are likewise of great importance; Japanese larch mixed with Port Orford cedar *(Chamaecyparis lawsoniana)*

and some holly, and *Eucalyptus urnigera* from Tasmania seemed to be fairly successful. The condition of the large collection of ericaceous plants was quite remarkable; with full exposure on the hillside several species of *Vaccinium, Gaultheria* and *Pernettya* all looked extremely healthy, while *Pernettya pumila*, about a yard square, was in full flower.

Amongst the forest plots some of the most flourishing were lodgepole pine (seeds from Long Beach, Washington); *Pinus muricata*, the bishop pine of northern California; western hemlock *(Tsuga heterophylla)*; the European fir *(Abies alba)*, Port Orford cedar, Leyland cypress, and three species of alders—the speckled, Italian and red alders. On the other hand, both giant sequoia *(Sequoiadendron giganteum)* and redwood *(Sequoia sempervirens)* seemed very unhappy, as were the sweet gum *(Liquidambar)*, tulip tree *(Liriodendron)*, the Colorado fir *(Abies concolor)* and our subalpine fir *(Abies lasiocarpa)*.

Leaving New Ross on the morning of May 2nd, we drove north up the main road for Dublin, via Enniscorthy and Arklow. Some fifteen miles south of the capital we turned west up a smaller road leading to Enniskerry and Powerscourt House, owned by Mrs. and Mrs. R. Slazenger, but frequently open to the public.

The stone house, completed in 1770, stands on a terrace overlooking a magnificent landscaped view to the Sugarloaf mountain in the distance. The garden was constructed by the seventh Lord Powerscourt between 1855 and 1875, on a grand scale to fit the site, with wide and steep grass slopes on either side of the valley below the house and groups of trees above and beyond these. At the bottom of the valley is a lake having a single jet fountain in its center. A wide staircase descends from the terrace towards the lake, at the foot of which a pair of Pegasus spread their wings.

There are some fine trees in the grounds on either side of this principal feature, including a double avenue of *Araucaria araucana* backed by Douglas firs up to nearly 150 feet tall. Many conifer specimens were planted in the late 1860s and are now splendid examples of their kinds: Nordmann and grand firs, Jeffrey and Monterey pines, and an enormous Monterey cypress planted in 1889 are some of these. The beeches lining the long drive up to the house are likewise remarkable and beautiful, although at this time they were still leafless. Powerscourt is a garden which should not be missed by anyone who appreciates the art of landscaping; it is one of the finest examples in Great Britain.

To reach the airport on the north side of Dublin we had to drive right through the city, which even with the aid of maps was not easy because of one-way streets, no right turns and the quantity of traffic. We turned in the car there and stayed overnight at the Airport Hotel, then departed next morning on the short (one hour) flight to Glasgow, Scotland, where another Hillman car awaited us. We set

Dwarf conifer borders at Benmore, Argyllshire, Scotland. Photo (in rain). May 4, 1973

off for Dunbartonshire on the north bank of the Clyde river over a new toll suspension bridge.

A few miles along the north bank we passed through Helensburgh and came to Rhu, where we were to stay the night with Mr. J. H. A. Gibson, joint owner with his brother of an old garden almost entirely devoted to rhododendrons and famous for their collection of these shrubs or, in some cases, trees. I had often read of it but never previously seen the garden.

This year it had clearly suffered from late spring frosts, but even so there were plenty of plants flowering, starting with a huge old *R. arboreum* on the lawn in front of the house, and not far from it another ancient and enormous plant of *R. falconeri*, raised from seeds brought home by Sir J. D. Hooker from Sikkim in 1848. Another species of much later introduction here, from seeds collected by the late George Sherriff, was *R. lindleyi*, with immense cup-shaped, fragrant, pale pink to pure white flowers, thriving in a variety of situations. Another tender (to us) and fragrant Himalayan species was *R. edgeworthii*, freer flowering than the former and more compact in habit; the yellow *R. campylocarpum* had attained about ten feet in height. Hybrids raised by Mr. Gibson included *R. falconeri x R. macabeanum*, now 22 years old and flowering, pale yellow as might be expected; *R. sinogrande x R. macabeanum; R. didymum x R. chamae-thomsonii*, of compact habit with blood-red flowers, and *R. racemoseum x R. tephropeplum*, about six feet tall, very free-flowering with small pale pink blooms. Another unusual member of the *Ericaceae* growing here was *Phyllodoce caerulea*, a rare Scottish native. Daffodils scattered throughout the garden added to the spring effect, as did the rain which fell frequently and made photography difficult.

Next morning it was still raining. We continued northwards beside Loch Lomond where the primroses were blooming on roadside banks, went through Arrochar into Argyllshire, down the east side of Loch Fyne to Strachur, then towards Kilmun and the Younger botanic garden and arboretum at Benmore, a place where it rains more often than not, to the amount of some ninety inches a year. The estate was formerly owned by Mr. H. G. Younger, but the garden is now controlled by the Royal Botanic Garden at Edinburgh. Arthur Hall is in charge of it and took us around.

Conifers and rhododendrons are the chief features, and both are outstanding for size and variety, no doubt largely due to the rainfall and mild climate. Most of the latter however had been damaged by the spring frosts, as at Rhu, and perhaps more so than there. *R. niveum* and *R. oreotrephes* were entirely spoiled; *R. adenogynum*, of the Taliense series, the flowers white with a crimson blotch, *R. morii*, about eleven feet tall, and the rare *R. pseudochrysanthum* from Taiwan had more or less withstood the cold weather. The flowers of the last are pink; the plant about three feet high, four feet wide.

While one of the notable features of Benmore is the avenue of giant sequoias, planted about 70 years ago, some of which have attained 130–140 ft. in height, there are other smaller conifers of interest to be seen in what was formerly an open area of lawn. Around the margin a collection of seventeen forms (cultivars) of Port Orford cedar *(Chamaecyparis lawsoniana)* have lately been planted, while in the long central and side borders the so-called dwarf types of many species continue to grow and display their great variety of size, form and coloring. More young plants of *Abies* species and of *Eucalyptus* have been planted on the hillside above the house, the former supplementing others already growing well under Douglas firs and other large trees accompanied by large leaved types of rhododendrons. Some of the Eucalyptus are already twenty feet high after three years growth.

For the night, we returned to the inn at Strachur which had been recommended to us by the Royal Botanic Garden, Edinburgh. It occupied an excellent site facing Loch Fyne and left nothing to be desired in the way of comfort and facilities.

Next morning, May 5th, we continued northwards, aiming for Inverness by evening, via Fort William. This necessitated crossing the desolate Rannoch Moor, covered with

heather and dotted with small lakes, rather like the approach to Beartooth Pass in northwestern Wyoming from Yellowstone National Park, though of course at a much lower altitude (about 3,000 feet), then down through almost treeless Glen Coe, of unhappy memory, in mist and low clouds to Ballachulish with its ferry across the mouth of the loch which was too crowded this day to utilise. From there about another thirty miles alongside Loch Linnhe brought us into Fort William and Inverness-shire. The West Highland museum here contains many relics of Bonny Prince Charlie and the rebellion of 1745; in the local shops is a large assortment of Scottish woollens and tweeds. Ben Nevis, the highest mountain in Great Britain (4,400 feet) is immediately east of the town, but owing to low clouds was invisible; snow was apparent on other lesser mountains.

Ten miles north of Fort William we turned northeast up Glen Spean, thence through Kingussie and along Strath Spey to Aviemore where we spent the night at the Post House hotel, built to cater for skiers more than summer customers; the skiing season had just finished. In Glen Spean we first noted forests of birches, mostly of old trees not reproducing on the sites. Younger trees were upright in habit with cream-white bark; no doubt this was *Betula pubescens*, the downy birch. There was a 250-acre forest of it behind the hotel at Aviemore, administered as a Nature Reserve since it is one of the largest remaining in Scotland.

Before lunch we drove up the road towards the snow-covered Cairngorm mountains and the ski lifts, through thin forest of Scots pines of varying ages with a ground cover of *Calluna, Vaccinium myrtillus* and *V. vitis-idaea,* except in one area of glacial till where the common juniper had taken over and was reproducing itself in all kinds of shapes and sizes. During the afternoon we achieved one of our principal objectives by visiting John Lawson's Inshriach nursery, formerly belonging to Jack Drake, who had built it into a first class collection of rare alpine plants obtained from all over the world. The nursery is located in a cold site and had recently suffered from frosts down to 20°F., of which the effect was obvious on young shoots of *Iris, Meconopsis, Primula* species, and even the buds of the western American skunk cabbage, *Lysichiton americanum*. A little stream runs through the garden to the river Spey. Some of the plants particularly noted included *Cassiope* (*C.* "Muirhead" was three feet in diameter!) and *Phyllodoce* species and hybrids; *Celmisia* species, from New Zealand; *Lewisia* species and hybrids, the former from the western United States, the latter mostly raised here; *Corydalis ambigua* from Japan with blue flowers; white and copper colored forms of the lesser celandine; *Ourisia macrocarpa* also from New Zealand; the dwarf *Sorbus reducta* from Western China and equally small *Salix apoda* from the Caucasus mountains, and flowering plants of the rare and handsome purple *Primula macrophylla* from the Himalaya.

We were driven into the alpine house by rain, but as this was filled with plants in

Scots pines in Glen Falloch, Perthshire, Scotland. May 5, 1973

bloom in containers this was even more delightful and pleasing. Among them were many European *Primula* species or their hybrids, lewisias, including pink forms of *L. tweedyi*, our native Washington species; a hybrid buttercup from New Zealand *(Ranunculus buchananiix R. sericophyllus)*; fritillarias, *Cassiope wardii*, androsaces, anemones, small daffodils, and many more. It was certainly a treasure house of such connoisseur's plants!

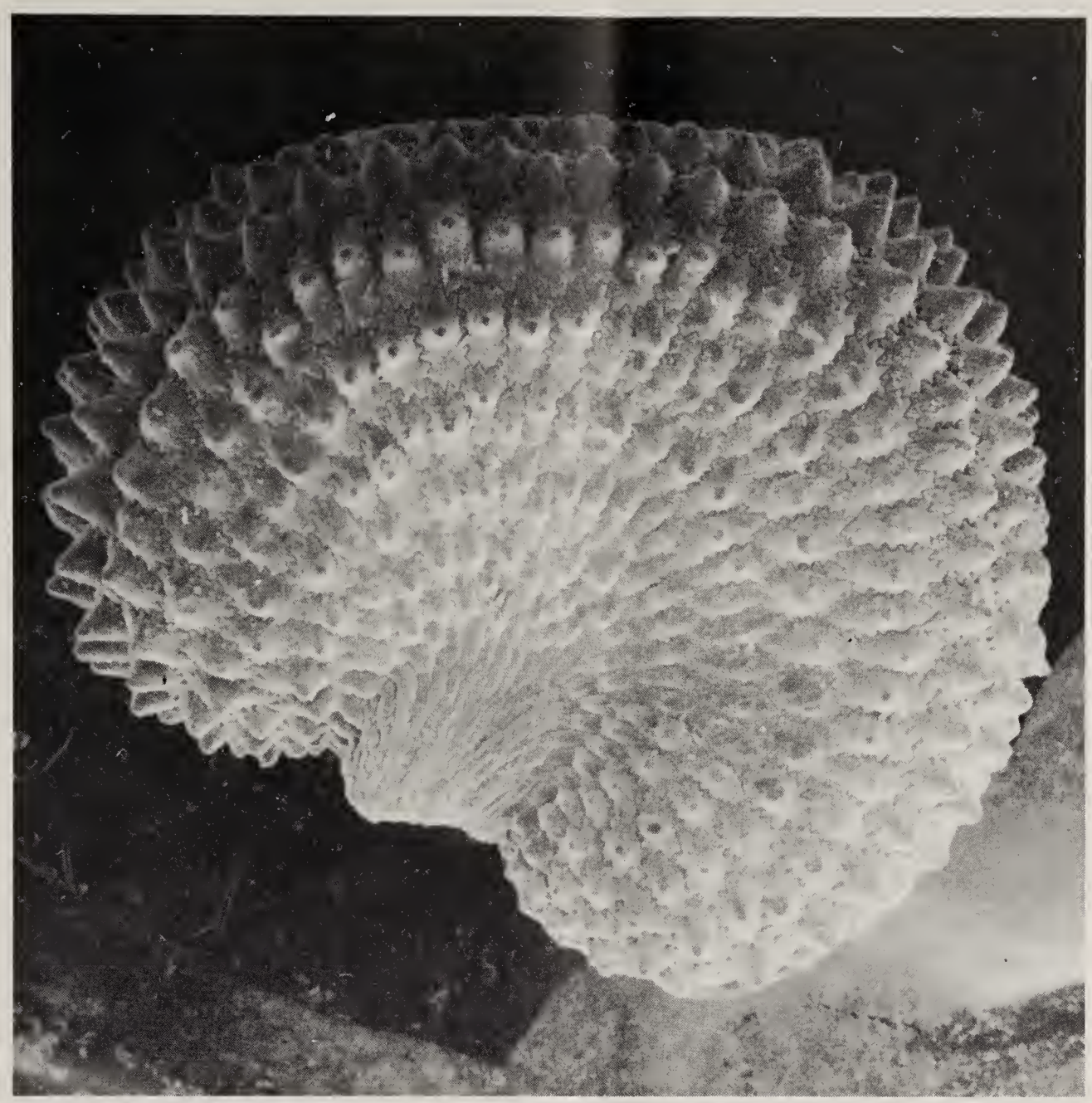
After having a warming cup of tea with the Lawson family we drove thirty miles into Inverness in pouring rain and checked in at a hotel in the center of the city, which proved to be one of the noisiest and least comfortable we encountered anywhere. We stayed two nights in order to visit Inverewe. It was an eighty mile drive over narrow roads each way. Some of the route is quite attractive where it passes through older woodlands; other portions consisted of very young forest plantings (Sitka spruce, lodgepole or Scots pines), and beyond Loch Maree of moorland covered with *Calluna*. When we reached Inverewe, which is situated on a small bay at the head of Loch Ewe, it was raining heavily so we went into the restaurant and had lunch, to give the weather time to improve before going round the garden.

The site is extremely exposed to prevailing southwesterly winds, but by planting shelter belts when the garden was begun by Osgood Mackenzie in 1865, of Corsican, Monterey and Scots pine, Douglas fir, western hemlock, beech and various other trees, with hedges of *R. ponticum*, enough protection has now been provided to allow the successful growth of many normally tender trees and shrubs, especially from New Zealand and Chile, and rhododendrons from the Himalaya and western China. Mr. Mackenzie lived until 1922; his daughter, Mrs. Sawyer, continued the work until 1953, and for the next seven years Dr. J. M. Cowan was in charge on behalf of the Scottish National Trust, to which Mrs. Sawyer handed over the estate in 1952.

The rhododendrons are certainly an outstanding feature: huge old specimens of the Himalayan species—*arboreum, campylocarpum, falconeri, thomsonii* and others—and of some of the Chinese, including an enormous plant of *R. sino-grande* about

(continued on p. 20)

Interior of alpine house at Inshriach Nursery, Aviemore, Scotland. May 6, 1973



Seed of *Silene cucubalus Wibel*, magnified 50x. Scanning electron microscope photograph, courtesy of Mrs. Yoko Tsukada, Quaternary Center, University of Washington.

Seeds and Fruits and their Dispersal Strategies

*B. J. D. MEEUSE**

INTRODUCTION

If punning were not in such dubious taste, one could say that on our planet the group of the flowering plants has really blossomed. So far, more than 300,000 species have been described, and these are distributed over all sorts of environments. From arctic tundra to tropical rain forest, from salt water marsh to fresh water pond and desert, one can find them—sometimes in countless numbers. Two factors have been very important in this success story: a) the development of various pollination-mechanisms, which in a rather foolproof fashion—and without the cooperation of free water which is so important for primitive plants with their free-swimming sperm cells—lead to the fusion of male and female sex cells, and thus ultimately to a new generation of plant individuals, often with new and promising combinations of genetical traits; and b) the so-called seed habit. True, the flowering plants have no monopoly when it comes to seeds; the extinct seed ferns already had them, and we find them also in the Gymnosperms (conifers, cycads, ginkgos and others). But it is in the flowering plants that they have played the most prominent role, associating and cooperating with other elements which, in their combined form, we refer to as fruits. Pollination has already been discussed in our ARBORETUM BULLETIN on various occa-

*Dr. Meeuse is a Professor of Botany at the University of Washington and a member of the Editorial Board. This is the first of a two-part article.

sions (Meeuse, "What's New in Pollination," 1972, Fall, p. 7 and Winter, p. 17). Our present article will deal solely with seeds and fruits.

Advantages of seeds over spores

Good evidence indicates that the flowering plants are the descendants of fern-like ancestors, and a comparison of the normal "dispersal unit" in ferns and flowering plants is therefore quite in order. In the ferns, it is the *spore*, a unit composed of a single cell which can legitimately be compared to a pollen grain. The lightness and smallness of spores, which are usually produced in large numbers, offer the advantage that the wind can easily blow them around, and in Nature's roulette game a few may land on moist soil where they will then germinate. But on the other hand it is physically impossible for units which are that small to contain the large amount of reserve material (starch or fat) which would be so desirable to give the young germling a headstart, or to "tide it over" under unfavorable conditions. Furthermore, a single-celled spore just does not give Nature enough opportunity to create the morphological structures (hairtufts or wings, hooks, etc.) that would be so helpful in its dispersal by wind or animals. True, in a few exceptional instances Nature has done at least *something*, e.g., in the case of the horsetail-spore with its four paper-thin appendages which together act as a device for keeping the spore airborne. But Nature can clearly do much more with a seed, which after all is composed of many cells. Some of these can be put to good use for the creation of dispersal organs, such as spines and hooks which will cling to animals, and hairtufts that will allow the wind to carry the seed aloft. Others can be used for the storage of reserve material—a fact, by the way, which man exploits to his own advantage.

Dormancy

It is logical to discuss still another success-factor, namely *dormancy* (a physiological state of rest, which may persist even when conditions for germination are favorable) in connection with the seed-habit and dispersal. After all, seed-dispersing agents (whether they be wind, water, animals or whatever) must in general be given *time* to act! This factor was not important in the type of environment (moist, constantly warm jungle) where the flowering plants probably arose and where short-distance dispersal, or even non-dispersal was usually sufficient. Indeed, we still find lack of dormancy in the seeds of many tropical plants such as mangoes. In most cultivated plants also, it is lacking, because man has from time immemorial selected against it—for obvious reasons. But in many wild plants of temperate and cold regions, dormancy is very important indeed—also for reasons which have nothing to do with dispersal *per se*. Birch seeds demonstrate this very nicely. In theory, one might expect that these would germinate immediately after ripening, say in September when conditions for germination are often ideal. However, in the harsh winter season still lying ahead, disaster would probably befall the young and very vulnerable seedlings. Dormancy prevents this from happening: the seeds just *don't* germinate! It also enables the seeds to survive the unfavorable season itself without harm. Often we find that, during the cold period, the natural inhibitors which in many cases are responsible for preventing germination, gradually disappear, so that in the spring when temperature and moisture are again favorable, the seeds will sprout readily. In combination with longevity, dormancy also is a safeguard against sudden catastrophes. Even if the whole "standing crop" of a plant species were wiped out, e.g., by a flood or the consequences of a volcanic eruption, survival of the species would be ensured because of the presence of dormant seeds in the soil. Good evidence indicates that seeds of the sacred lotus, *Nelumbo nucifera*, can retain their viability for more than a thousand years! Of interest also is the phenomenon of *differential dormancy*. In some plant species, an individual may produce seeds with a very pronounced dormancy as well as others where it is totally or partially lacking. It is easy to see that this too is an "insurance" (by the species) against the vagaries of the natural environment.

Order from chaos

Returning to what we can observe for ourselves, it has to be admitted that at first sight the multitude of seeds and fruits around us, confronting us with all sorts of shapes, sizes, weights, colors, textures, and behaviors, is absolutely bewildering. However, a pleasing degree of understanding can be derived even from this seemingly wild mess when we approach it with an appreciation of both *function* (the "engineering" point of view!) and *history*—the latter, in this case, being the origin and development of the flowering plants and their structures, a topic about which we can at least make some very plausible guesses. Especially in the biology of seeds and fruits, the solution to certain problems that seems ideal from the "engineering" standpoint must, of necessity, be superimposed on what was present (and worked!) before. Compromises result, and perhaps it is this interplay between functional demands and history that makes seed- and fruit-ecology so fascinating; like diplomacy, it is "the art of the possible."

Primitive seeds and fruits

Seeds arise from ovules ("seed-buds" in some languages), which normally differentiate into seeds only after pollination and fertilization have taken place. In the immediate ancestors of the flowering plants, the ovules were essentially freely exposed—as they still are in present-day Gymnosperms. The seed-structure of *Ginkgo* (often described as a living fossil) may well reflect the most primitive condition. The outer layer of the seed-coat or testa is fleshy, the reason why it is called a *sarcotesta*; the inner layer forms a hard *sclerotesta*. The whole seed thus resembles a modern stone-fruit. It falls to the ground and develops a strong odor, due to butyric acid formation. This behavior can be seen as an adaptation to dispersal (millions of years ago!) by terrestrial reptiles which probably swallowed the seeds whole. The plausibility of this interpretation follows from the fact that in 1930 certain fossil reptiles *(Protorosaurus)* from the Zechstein formation were found to have a whole collection of large, intact gymnosperm seeds of uniform size (and thus probably ripe!) in their stomachs. Later on, such seeds were also found in their coproliths (fossil faeces). The seeds were thus dispersed intact! The same can be said about the seeds of some modern cycads such as *Zamia* and *Macrozamia* which are eaten and dispersed by birds (*Macrozamia* by emus). Some recent conifers *(Podocarpus* and *Cephalotaxus)* also still have a sarcotesta, while the red and sweet-tasting *aril* of *Taxus* (Fig. 1)*, which undoubtedly has a function in dispersal (by birds) can be interpreted as a sarcotesta-derivative.

The flowering plants enclosed their ovules in somewhat leaf-like structures called *carpels*. This strategy offered advantages in the realm of pollination: beetles, probably the earliest pollinators, tend to be rather destructive, so that the ovules were in need of protection. In addition, the upper part of the closed carpels differentiated into a *stigma*, a special site which not only permitted the collection and germination of pollen grains but also acted as a "sieve" or barrier, discriminating against undesirable pollen from other species. Beneficial though these developments were in the sexual sphere, they carried with them a potential for disaster from the standpoint of dispersal: what good is an attractive sarcotesta when it is hidden from view? As demonstrated to us by Nature, escape from the dilemma (or at least a compromise!) is possible in various ways. In some cases, the carpel (or a group of fused carpels, which together form the pistil and later the fruit) opens up immediately after pollination, exposing the sarcotesta-seeds. Fig. 2 shows this for a *Magnolia*-species. Exposure here is further improved because the seeds dangle from slender but strong threads. Fig. 3 shows a comparable situation for *Euonymus cornutus var. quinquecornutus*, while Fig. 4 illustrates the display of sarcotesta-seeds in *Iris foetidissima*.

In other cases, the attracting function of the sarcotesta was taken over by the fruit (which, usually, is the structure that develops from a carpel, or a group of fused carpels, after pollination). From the

*Figures refer to pictures appearing on pp. 16 and 17.

functional point of view, a "modern" stone-fruit such as a cherry and an "ancient" type seed such as that of *Magnolia* or *Ginkgo* are essentially the same!

Dispersal by animals: zoochory

Since we have argued that dispersal by animals (zoochory) is primitive, it makes sense to discuss first of all this type of transport. One can establish various dispersal classes on the basis of the dispersing agents (e.g., ornithochory or dispersal by birds, myrmecochory or dispersal by ants, etc.); however, it is wise to consider also *how* and *where* the dispersal units (diaspores) are carried. Thus, one can recognize *endozoochory*, in which the diaspores are carried inside the animal; *synzoochory*, in which the diaspores are deliberately carried, usually in the mouth (as in some birds and all seed-carrying ants); and *epizoochory*, in which the diaspores, acting as "hitch-hikers," are accidentally carried on the outside of the animal. *Saurochory* (dispersal by reptiles) is not very important, since among modern reptiles there are only a handful of vegetarians left: some turtles and tortoises, and a few lizards (iguanas). The rather hard fruits of *Annona palustris*, known as alligator-apples, are eaten by iguanas and alligators after having dropped off the tree. The giant tortoise of the Galapagos Islands plays a role in the dispersal of cactuses and a local tomato-variety.

Ornithochory

The dispersal by birds (which can be considered as warm-blooded reptiles with feathers!) is very important indeed. In many cases, it has the advantage of being "directed": after having picked up the seeds of a given plant in a certain habitat such as a thicket, which is favorable for that plant, a bird is likely to fly to another spot which is very similar and may therefore also be near-optimal. Migrating birds can transport plant diaspores over considerable distances. Vernon Proctor found that viable seeds of *Celtis, Convolvulus, Malva* and *Rhus* were regurgitated from the digestive tract of kildeer *(Charadrius vociferus)* after 160, 144, 152, and 340 hours, respectively—ample time for a long flight![1] Similar results were obtained with least sandpipers *(Erolia minutilla)*.

Endozoochory by birds

Birds have excellent color vision, but a weak sense of smell. Accordingly, many of the diaspores dispersed after being eaten by birds (endozoochory) are vividly colored (often red, orange or blue); smell may be absent. When ripe, the edible part is good-tasting, juicy and sweet or oily (the other side of this coin is that the immature fruit usually is green in color, and also sour or otherwise unpalatable, as a protection against the dispersal of unripe seed). The seed is protected against digestion by being hard, and by itself is not attractive to the bird on account of bitterness or the presence of toxic substances. The dispersal units remain attached to the plant even when ripe (some may last almost through the winter!). They are clearly visible, but are not attached to a special part of the plant (such as the base of a tree). When fleshy, the fruits have no continuous, hard outer part. In the case of hard and dry fruits, the attractive seeds are exposed or dangle. Of course, not *all* these features have to be present in a given case! An example of the "bird-syndrome" is seen in our Fig. 5.

Mimetic seeds

A fascinating type of deceit is practiced by certain hard, dry and in principle inedible leguminous seeds such as those of *Abrus precatorius* (the precatory bean), *Adenanthera pavonina*, and some *Ormosia*- and *Rhynchosia*-species (see Fig. 6). These mimic the "primitive" seeds with edible sarcotesta or aril which we have already discussed; accordingly, their colors are often red and black, or just red. Because of their attractiveness and good keeping quality, such "coral seeds" are often used for rosaries and necklaces. Like the mushroom in

---

[1]V. De Vlaming & V. Proctor, "Dispersal of Aquatic Organisms: Viability of Seeds Recovered from the Droppings of Captured Kildeer and Mallard Ducks." *American Journal of Botany*, 55, (1968) pp. 20-26.

Alice in Wonderland, they seem to cry out "Eat me, eat me." What they show is, actually, mimicry in reverse. Admittedly, the black and red color scheme is one often found in insects with warning colors, which a predator-bird soon learns to avoid. However, it is good to keep in mind that birds interested in seeds are not pronounced insectivores; they are not repelled by this particular color-combination.

Synzoochory (the deliberate carrying of diaspores) by birds is well-known in crows, nutcrackers and jays. The latter build up caches, for example, of acorns or hazelnuts, but some of these are dropped along the way and others are forgotten. In a German locality, the average jay transported 4,600 acorns in one season, mostly over a distance of four kilometers (two and one-half miles). Crows may well have played a main role in the "re-colonization" of the British isles by oaks, a process that started in the southwest and took 2,000 years; this required an advance

Piece of limb of *Quercus garryana* showing acorns imbedded by acorn woodpecker. *Photo:* B. J. D. Meeuse

Branches of *Quercus garryana*, full of holes made by the acorn woodpecker (California woodpecker). Each individual hole corresponds with one acorn which is imbedded. Finley National Wildlife Refuge, Corvallis, Oregon. September, 1973. *Photo:* B. J. D. Meeuse

of six miles for every twenty-year generation, which seems well within the realm of possibilities. The California woodpecker stashes away thousands of acorns (and sometimes also almonds and pecans!) in individual holes which it makes in the wood of dead trees and telephone poles, or in the bark of living ones. Jays and rodents sometimes steal the imbedded and still viable diaspores, and this can lead to dispersal.

Epizoochory by birds, the inadvertent carrying of diaspores on the body, is rare for the larger diaspores because of the animals' preening-habits. However, the very sticky fruits of *Pisonia* (a member of the four o'clock family), which are often used for making bird-lime, are transported even to remote Pacific islands in this fashion. Much more common is the transport of tiny, not especially adapted, diaspores with the mud that sticks to the legs or body of waterfowl. With his usual patience and thoroughness, Charles Darwin has investigated this situation, which is responsible for the sudden appearance of swamp plants along the margins of isolated ponds. Ridley, in his famous book on dispersal, gives seven pages (!) of examples, including species of rushes, sedges, grasses, water-plantain, water-smartweed, and many others.[2]

[2]H. N. Ridley, *The Dispersal of Plants throughout the World*. Reeve, Ashford, 1930.

(To be continued)

Fig. 1. Red aril of *Taxus*

Fig. 2. Dangling seed of *Magnolia*, with sarcotesta

Fig. 4. Fruit and seeds of *Iris foetidissima*. Sarcotesta-see dispersed by birds.

Mr. Sigurd Olsen, whose photographs appe pages, has done extensive research on bota at the University of Copenhagen, for the ci University of Washington where he is pr Professor in the College of Fisheries. He has ous scientific grants and has an impressive li in photography, developed early in his caree to give a lecture-demonstration of photogra biology teachers at the University of Washir it has become an annual affair.

Fig. 3. Exposed sarcotesta-seeds of *Euonymus cornutus* var. *quinque-cornutus*

Various Adaptations to Dispersal by Birds

on the cover and on these
cal and biological subjects
f Copenhagen, and at the
ntly an affiliate Assistant
en the recipient of numer-
f publications. His interest
as sharpened by a request
ic methods for pre-service
n, a project so successful

Fig. 5. *Sorbus aucuparia* (Rowan berry or mountain ash) fruits attractive to birds.

Fig. 6. Red and black *Rhynchosia* seeds (and pods) show mimicry in reverse! Although the seeds are dry, they are taken by the birds.

Arboretum Classes

The Arboretum is open to the public for education and recreation. The College of Forest Resources coordinates the educational activities of the Arboretum. For further information, phone 543-2730. To register for classes, registration blanks are provided in SPECTRUM. If you wish your name to be placed on the list to receive SPECTRUM, phone 543-2590 or write University of Washington (DW-20), 400 Lewis Hall, Seattle, Wa. 98195.

WINTER PROPAGATION Mr. Richard van Klaveren, Arboretum propagator, will teach techniques for propagagating woody plants, including cutting and seeding. Arboretum greenhouse; class limited to 10. Saturdays, January 12 and 26; 9:30 a.m.-noon. 2 sessions, $10.

GRAFTING ORNAMENTALS Mr. van Klaveren will instruct in techniques for grafting woody plants. Materials will be furnished. Arboretum greenhouse; class limited to 10. Saturdays, February 2 and 24; 9:30 a.m.-noon. 2 sessions, $10.

GARDEN NUTRITION Dr. Stanley P. Gessel, Professor of Soils, will coordinate this lecture-discussion class. Topics will include soil types, composts, mulches, and fertilizers. 201 Winkenwerder, University campus; class limited to 30. Mondays, February 4-25; 7-9 p.m. 4 sessions, $10.

Did you know that a selection of gardening books is available at the Foundation office? This is a service provided for all Foundation members by the Book Committee of the Foundation. If you have a book you would like to obtain, or if you want to know of some titles available in horticulture subjects, visit the Foundation office. All books on the shelf are for sale at a special price to members. THE LONG ROAD TRAVELLED and THE URBAN ARBORETUM IN TIME OF CRISIS are good background information about our Arboretum. The new books which you will want to see are Hitchcock's FLORA OF THE PACIFIC NORTHWEST and Kozlaf's SEASHORE LIFE OF THE PUGET SOUND, THE STRAIT OF GEORGIA AND SAN JUAN ARCHIPELAGO. A re-issue of a long out-of-print book is Dr. Erna Gunther's ETHNOBOTANY. You will want one for your library!

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (August 1, 1973 through October 31, 1973):

Contributing — Mrs. Walter O. Husfloen. *Sustaining* —M. Daniel Jacpubovitch, Mrs. E. R. Zimmerly. *Annual* — Mrs. Noel Bergquist, Mrs. Walter Bettin, Mrs. Richard C. Boughner, Elizabeth Boyle, Mrs. Ferderick P. Brandauer, Mrs. Peter L. Buck, Mrs. P. M. Casady, J. Don Christenson, Dorothy J. Christianson, Mrs. William H. Cleaver, Mrs. Wilbur Cosby, Mrs. James P. Crutcher, Mrs. Charles Davidson, Mrs. John Denny, Mrs. Rupert I. Dorn, Mrs. Timothy Easter, Mrs. Tom Emrich, Mrs. O. Wallace Fisher, Mrs. James C. Glass, Mrs. Glenn A. Hall, Mrs. Martha Harrison, R. L. Herriott, Mrs. Janet E. Hicks, Mrs. W. G. Hiltner, Mrs. Henry Jovag, R. William Kellel, Patricia P. Knopp, Mrs. Thomas C. Larsen, Dr. & Mrs. Arthur Launder, Mrs. Douglas S. Little, Jerry Lowell, Mrs. H. H. Maddax, Mrs. Rod McNae, Mrs. Lorraine Meisner, David C. Mirgon, Esquio Narro, Mrs. Thomas C. Nielsen, Mrs. Richard Ohmes, Mrs. Michael V. Pittier, Mrs. Joseph H. Rantz, Mrs. Mark W. Ritchey, Mrs. Lowell Roberts, Mrs. Robert Rutter, Mrs. John Sherris, Mrs. Clark S. Smith, Mrs. Evelyn Stanchfield, Mrs. Leroy E. Stein, Miss Barbara M. Strum, Mrs. James F. Taylor, Edgar Thomas, Mrs. H. H. Towler, Mrs. John J. Valko, Mrs. Roger Williams, Mrs. David Wolter, Mrs. Dale H. Zeigler.

We are also grateful to the following members who have increased their dues to: *Supporting* — Mrs. Charles H. Gordon. *Contributing* — Dr. & Mrs. John W. Anderson. *Sustaining* — Mrs. Lowell V. Casey, Mrs. Herbert Drew, Mrs. Curtis R. Eckberg, Mrs. F. B. Fite, Jr., Miss Sarah E. Rapalje.

Photo:
Don Normark

Arboretum Spotlight

Sarcococca hookeriana var. *digyna*

Name a plant with the following attributes: evergreen foliage, compact low growth habit, winter blooming, fragrant flowers, ability to thrive in dry shady conditions, and hardy enough to withstand our coldest winters. If you do name such a plant you probably will say *Sarcococca*. Two species of the sweet or winter box are commonly grown, *S. humilis* and *S. ruscifolia*, although the latter is often confused with still a third species, *S. confusa*. To my mind, however, the best of sweet box is much less common, perhaps because it has such a tongue twisting name.

Sarcococca hookeriana var. *digyna* is native to western China and was introduced to England by E. H. Wilson in 1908 from Szechwan. It develops into a dense creeping shrub three or four feet tall with purplish stems and narrow evergreen green leaves, up to four inches long and less than half an inch wide with long acuminate tips. The flowers which appear in December and January are without petals, merely clusters of white staminate or pistillate flowers in a small head. What they lack in showiness they make up in fragrance, since they produce such a potent perfume that one tiny spray can be nearly overpowering in a small room.

The flowers are followed by 3/8 inch long egg-shaped fruits, blue black, that take nearly a year to ripen. In the Arboretum *S. hookeriana* var. *digyna* does not set fruit as freely as do the other species, particularly *S. confusa* which is often covered with its shiny black berries.

There are several plants of *S. hookeriana* var. *digyna* in the Arboretum with the best being near the north end of the large parking lot for Rhododendron Glen along Arboretum Drive E. Here it has formed a dense cover on a dry and shady bank. It is interesting to see that where the plants of this group are exposed to the afternoon sun the leaves are yellow green while those in the deeper shade are dark green. The rhizomatous habit makes it a good colonizer; it is not overly aggressive yet moves out at a good steady pace.

A warm rainy day in December or January is a good time to visit this bed to see the narrow leaves bejeweled with raindrops and to smell the sweet fragrance.

J. A. Witt

Plants in terrace border at Inverewe House, n. w. Scotland. *Celmisia* species, *Helichrysum, Pimelea, Olearia*. May 7, 1973

Gardens

(continued from p. 10)

twenty-five feet high, thirty feet in width; *R. rubiginosum* in full bloom, about eighteen feet tall. Damage from recent frosts could be seen on some of the flowers, although not so severe as at Rhu or Benmore. Later plantings also flowering included *R. edgeworthii, R. johnstoneanum*, and the beautiful hybrid, *R. 'Trewithen Orange.'* A big specimen of the blood-red flowered *R. 'Shibonii'* was at its peak.

Besides the rhododendrons there were plenty of other plants of interest or beauty. A border along the top of a terrace wall near the house contained many plants from New Zealand—*Celmisia* species, *Helichrysum, Pimelea, Olearia*—while in the shelter of the trees nearby was a delightful planting of a hybrid white-flowered *Ourisia* around an early flowering willow *(Salix hastata 'Wehrhahnii')*. Among trees of note we saw a *Magnolia campbellii* forty feet high, *Drimys winteri*, the anti-scorbutic Winter's bark, the firebush, *Embothrium coccineum*, from southern Chile, and a fine specimen of the Tasmanian *Eucalyptus coccifera* near the entrance. The garden contains some 2,500 different kinds of plants and therefore can show something to attract all kinds of plant lovers throughout most of the year.

Next day, May 8th, there was some welcome improvement in the weather. We drove south down the Spey valley through Aviemore and Kingussie, where we noticed and photographed the familiar Kinnikinnick *(Arctostaphylos uva-ursi)* growing on a roadside bank just as it does at home, through the charming village of Blair Atholl, over the pass of Killiecrankie to Pitlochry, where we had lunch. Later in the day we reached the home of Mr. and Mrs. Peter Cox at Glendoick, between Perth and Dundee, where we stayed for that night and part of next day. Here they operate a successful nursery, largely devoted to dwarf rhododendrons and related plants of the *Ericaceae* family, and have recently opened a garden center, the first in this area. The garden at Glendoick however, is considerably older, and contains many unusual specimen trees and shrubs planted by Mr. E. H. M. Cox (father of Peter and author of *FARRER'S LAST JOURNEY* and other works), some of which originated from seeds collected in China or Upper Burma. Inside the old walled garden near the house a former herbaceous border has been converted into a collection of ericaceous plants, among them dwarf species of rhododendrons *(R. kotschyi, R. lowndesii* with its pale yellow open flowers, and the prostrate *R. nakaharai* from Taiwan); *Kalminopsis Leachiana* from southwest Oregon; cassiopes, phyllodoces, etc. On a wall in another part of the garden is an assortment of *Ceanothus*, including an old plant of our *C. impressus* 'Puget Blue' and the less hardy *C. arboreus* 'Trewithen Blue.' Up on the hillside above the house much new planting of rhododendrons has been done recently, of both species and hybrids, to supplement or replace some of the older plants; we saw *R.* 'Cotton Candy' and *R.* 'Hotai' among the hybrids. Deer are a nuisance here, and rabbits plentiful. The nursery area is also up on the hillside, which provides good air drainage; plantings are in long beds, each about eight feet wide. Most are of dwarf

species of *Rhododendron* and of the hybrids raised here, such as the yellow *R.* 'Chikor,' *R.* 'Curlew' and others, with more yet to come. A bed of about 200 plants of *Kalmiopsis* raised from home-saved seeds was flowering freely. Shelter from wind is provided by a long hedge of the hybrid *Cupressocyparis leylandii*.

From Perth into Edinburgh via the new toll bridge over the Firth of Forth is only an hour's drive, so about 3:15 p.m. that afternoon we were unloading our bags at the County Hotel, having an appointment a little later to show slides of some of our native western American alpine plants in the wild state to members of the staff and students at the Royal Botanic Garden. On the following morning, May 10th, we turned in the car (mileage 694) and took a taxi to the Botanic Garden where we spent the rest of the day, having lunch in the small restaurant in the grounds.

It is impossible to do justice to this remarkable collection of plants of all kinds founded in 1670, cultivated for 150 years on this same site in the midst of a busy city, with a far from amenable climate. Today it is recognised as one of the leading institutions of its kind in the entire world and is probably at the peak of its development and reputation. Here you will find plants of every kind, either outdoors or in the new and most carefully designed range of greenhouses which at one end cultivates ferns, at the other cacti and succulent plants from the world's dry regions. This is a most valuable and informative feature for any visitor, especially on a wet afternoon; having an upper level walkway on which the visitor can walk and look down on the vegetation below adds greatly to the overall effect and one's appreciation of it.

In the cactus house I particularly noted the almost prostrate *Pelargonium tricolor*, with red and white flowers over grey foliage, two species of begonias, namely *B. oxyphylla*, five to six feet in height, with corymbs of small white flowers, and *B. rufo-sericea*, about half that height and not flowering but with attractive red foliage. On the sandy ground the brilliant scarlet flower of *Rebutia grandiflora*, a cactus from Argentina, caught one's eye, though the plant which bore it was only three to four inches high. Several species of *Kalanchoe* from Madagascar also appeared to have considerable merit, espcially the prostrate, pink flowered *K. pumila* with its grey foliage.

Flowering on or near the rock garden at this time were the very ornamental *Salix lanata*, a shrub about four feet high but perhaps twice that width, with most conspicuous yellow catkins; *Rhododendron sargentianum*, a very old plant three and one half feet in diameter, covered with its pale yellow flowers, and a group of *R. tephropeplum* above a rock, the flowers large for this species and bright pink in color. New planting was going on at this date, including a group of young celmisias on top of a rock outcrop. This genus from New Zealand grows

(continued on p. 23)

View in rock garden, Royal Botanic Garden, Edinburgh. *Salix lanata* flowering beside pool. May 10, 1973

What's *Bugging* your PLANT?

SHARON COLLMAN

1. Spruce Aphids

Small, dull-green aphids feeding on needles of spruce.

Photo: Sharon Collman

The Spruce Aphid clearly belongs on the Ten-Most-Wanted list of insect pests. It has succeeded not only in eluding the craftiest of gardeners, but is clever enough to see that the blame is shifted onto the environment, disease or the red spider mite. Even more devious, is the fact that it does its work in February while the gardener is still hibernating in front of the fireplace or TV. Often by the time the damage is noticed in the spring, the aphid is nearly—or long gone.

The aphid itself is a small dull-green insect, hardly larger than the head of a pin. The insect appears in early February and settles on the old needles. As the aphid sucks the needle dry, the surrounding area becomes yellow, giving the needle a banded appearance. Gradually, the yellow area expands to cover most of the needle and the area turns brown. Eventually the needle drops from the tree. Since the damage is gradual and not very noticeable from a distance, it isn't until mid-March or April that the extent of defoliation is noticed. By then the damage is done and the insect gone (or overlooked due to its small size), and the gardener is left to puzzle over the cause.

Last year, aphid damage to spruce was extremely heavy. Even the novice could recognize spruce from afar, from the brown and bare centers. Yet even with such a severe attack, the trees remain alive. Alive, yes. But not so healthy. The heavily defoliated trees have been weakened, making them susceptible to drought injury, winter damage, or attack by wood-boring insects. Consequently, unless the trees have been given good cultural care (deep watering and light fertilization in the spring and summer), and protected from frost damage this winter they may yet continue to decline and eventually die. On the bright side the trees may

*This is the first of a series of articles to be prepared for the Bulletin by Sharon Collman, Assistant Area Extension Agent for King and Pierce counties.

Spruce tree severely defoliated by spruce aphids.
Photo: Sharon Collman

recover nicely if they were healthy to start, if the winter is not too severe and they are given careful attention next spring.

The first step to take in nurturing weakened trees back to health is to make sure they are still alive. Then make sure they are well protected against the winter frosts and winds. Young trees should be staked so that they won't blow over in the wind, and the bark can be wrapped with a special tape for frost protection.

Next, the first day of February, begin inspection of the tree for the presence of the small dull-green aphids on the needles. Continue to inspect at weekly intervals until April. If you find only a few aphids per branch, do not be concerned. If however, the aphids are numerous do not delay. Normal biological controls are not very effective when large numbers of aphids are already present. In February and March, it is too cold for ladybugs and praying mantis'. Therefore, the alternatives are chemical insecticides or living with the resulting damage. Good control can be obtain by using one of the following:

Diazinon — 25% emulsifiable concentrate — 2 teaspoons per gallon of water

Malathion — 57% EC — 2 teaspons per gallon of water

Meta-Systox — R — 13.2% EC — 1 tablespoon per gallon of water

Spray when aphids first appear heavy and again 10 days later. Be sure to *Read the Label* and follow the directions *carefully* and *precisely*. (If a little is good, a lot is *not* better.)

Gardens
(continued from p. 21)

surprisingly well in this dry, cool climate, much better than in Seattle, although perhaps we have not been able to give them sufficient trial. The dwarf *Prunus prostrata* from the eastern end of the Mediterranean and western Asia was an unusual species flowering here, with small, pink flowers; the plant was four feet in diameter so evidently of considerable age.

An especially floriferous small shrub outside the new greenhouses was the hybrid *Hebe x Fairfieldii* from New Zealand, covered with elongated spikes of white blossoms. I am glad to say that this interesting novelty is now established in Seattle and hopefully will make its way into some of our local gardens before long.

I must also record our appreciation and pleasure in again meeting Mr. Douglas Henderson, presently Regius Keeper of the Botanic Garden, and his predecessor in that office, Dr. H. R. Fletcher, both of whom were most helpful in making arrangements for this part of our journey. Without such friends along the way our travels would have been much more difficult and less enjoyable.

(to be continued)

An Herbarium for the Arboretum

*JOY M. SPURR**

The ultimate goal of the Herbarium Committee of the Arboretum Foundation Unit Council is to collect and dry plant specimens to preserve for all time a record of the valuable plantings in the University of Washington Arboretum.

"Why collect a bunch of dried-up old plants?" someone may ask. Why, indeed? The Arboretum needs a history of its plants for reference, research and as a teaching aid. A collection of dried plant specimens is as valuable a record to the Arboretum staff as is a source of original documents to the historian.

It is anticipated the growing herbarium collection will become a useful source of learning for teachers, botanists, nurserymen, horticulturists, landscape architects, gardeners, artists, writers and everyone who works with, and is interested in, plants.

Plant collecting has endured since the first botanists explored the continent. They learned that dried plant specimens were easy to transport and, if properly prepared, would last indefinitely. Through the years herbarium methods and equipment have become somewhat standardized.

A worthy herbarium contains specimens that are collected during different seasons of the year to show distinguishing plant characteristics in new foliage, mature foliage, fall color, flowers, fruit and even winter twigs. In a collection of herbaceous plants, the root system as well as the aerial portion is important. But in collecting only woody plants, a representative part of a branch, usually a terminal portion, is sufficient. (Imagine Joe Witt's reaction if the Herbarium Committee were to dig up a 10-foot *Rhododendron* 'Loderi King George' for instance, to preserve its root system for posterity!)

The Herbarium Committee follows recommended methods and is interested in devising or learning of new methods. It collects only in the Arboretum. The tools required are sharp pruning shears, plastic sacks for the specimens to protect them from damage and excessive wilting, and paper labels on which to write the date of collection, and the scientific name and catalog number that is stamped on the metal label attached to the tree or shrub.

Since "catching" the specimens is of no difficulty, the challenge is to select typical specimens that are free of insect or other damage and to prepare them carefully. Plants must be dried quickly for good color retention and they must be dried under pressure to prevent wrinkling.

The secret of well-prepared herbarium specimens depends upon the care taken during the drying process. In preparing a specimen for drying, it is trimmed to fit the standard 11½ × 16½ herbarium sheet. Then a sandwich system is begun as follows:

1. A cardboard is placed on the wooden bottom of the plant press.
2. The specimen is laid on a sheet of newspaper in the press. The leaves are arranged so that the underside of at least one or more will show, the upper sides of the others. Flowers are likewise arranged. (Plants too long for the sheet are bent into "V" or "N" shapes.)
3. An identification label is placed with each specimen. THIS IS VERY IMPORTANT.
4. Several thicknesses of newspaper (or blotter) are placed over the plant.

---

*Mrs. Roger Spurr has served the Foundation and the Unit Council in many capacities. This project begun by her is now being chairmaned by Mrs. W. E. Williams. Mrs. Spurr is presently Foundation Publicity Chairman. Her photographs and articles have appeared frequently in the BULLETIN.

5. A sheet of cardboard covers the entire procedure.
6. The next plant is then prepared in the same manner and the sandwich process continues.

When all plants have been sandwiched and stacked, the top cover of the press is put in place and the two straps are secured as tightly as possible using self-locking buckles on the straps. Pressure prevents wrinkling as drying takes place.

If leaves, flowers or fruit must be removed from the specimen a short stub of the stem is left on the main stem. Berries are flattened and dried with the plant, or if too large and fleshy, they may be freeze-dried.

The filled press may be set over a floor register, near a fan or in a box warmed by light bulbs, to increase the speed of drying. Care must be taken for if the temperature is too hot, dried plants will crumble to dust. During the first day the newspapers or blotters are changed for new ones at least several times and once-a-day for several days thereafter. Plants with thick leaves, or plants collected under moist atmospheric conditions, may take longer to dry. If plants are not thoroughly dried before they are mounted on the herbarium sheets, they may mold.

The dried specimen is mounted on a standard size white herbarium sheet. Before mounting, however, it is placed upright against one side of a large cardboard box (one side removed) and given a light spray with 3M Spray Adhesive #77.* Then it is immediately placed on the mounting sheet with the stem running up and down the long way of the sheet. The adhesive dries colorless and makes immediate contact so that the specimen cannot be moved after it is placed on the mounting sheet.

At the lower right-hand corner of the herbarium sheet an identification label which lists family, genus, species, popular name, locality collected, date collected, name of collector and remarks regarding definitive characteristics of the plant is attached. The label gives credit to the Arboretum Foundation Unit Council. The herbarium sheet is numbered and cataloged in a 3″ × 5″ master card file.

Extra dried flowers, fruits or leaves may be placed in a small envelope and attached to the lower left-hand side of the sheet. If the fruits are large, they are filed separately and cross-referenced with the herbarium sheet.

The final consideration is storage. It is a standard rule with botanists to file herbarium sheets according to taxonomic groups. Within the groups an alphabetical arrangement by genera is most convenient. Several herbarium sheets are stored in a folder and then the folders are placed in a metal herbarium cabinet. Moth crystals or similar repellent placed in the storage area will protect the specimens from attack by insects. We are presently protecting each herbarium sheet with a cover of clear acetate. The covers can be removed easily to examine the specimen, and at some future date, when space for the herbarium in a new Arboretum administration building becomes a reality, the taxonomist may desire to remove these covers. In the meantime the specimens are protected from damage during handling and display.

The herbarium for the Arboretum was conceived in 1935 and is referred to in the Bylaws of the Arboretum Foundation, Article I, Purposes and Objectives:

"The purposes and objectives of the corporation are to promote, foster and assist in the establishment, development, growth and maintenance of an Arboretum, Botanical Garden and *Herbarium* to be located in the area in Seattle, King County, Washington, set apart for that purpose by the Park Board of the City of Seattle, the same to be under the supervision of the University of Washington . . . "

Through the efforts of Mrs. Roger Spurr in the fall of 1969, approval to start the herbarium collection was given by the Arboretum Foundation and its Unit Council Governing Board, and Brian O. Mulligan,

---

*Recent research has resulted in many spray adhesives being banned on suspicion of chromosome damage. Great care should be taken to insure that the adhesive being used is safe for the individuals using it.

Director of the Arboretum. On October 1, 1969, James S. Bethel, Dean of the College of Forest Resources, addressed a letter to Robert J. Behnke, President, Arboretum Foundation, and included the comment, "This sounds to us like a meritorious project which, if properly executed, would result in making the Arboretum a more useful device in a number of respects. With proper advance planning this can be fitted into the new building complex with maximum efficiency . . . Under the foregoing conditions the herbarium project is approved."

On November 19, 1970, Mrs. Roger Spurr, Mrs. H. P. Clausing and Mrs. D. Henderson met with Dr. Leo Hitchcock, Reid Kenady and Joseph Witt to discuss details of starting the herbarium collection and to coordinate with the system used in the Botany Department's herbarium at the University of Washington.

The first specimens for the herbarium, *Acer palmatum* varieties, were collected on October 12, 1970, and the Herbarium Committee was organized by Mrs. Roger Spurr, Mrs. Donald Close, Mrs. Robert Hayek and Mrs. John Schwager (deceased January 7, 1972). Mrs. Walter Benckert joined the committee four months later and more recently the committee welcomed to its meetings Mrs. E. A. Niemeier, Mrs. Kenneth Wise, Mrs. John Miglorie, Mrs. Gayton Bailey and Mrs. W. E. Williams. The committee meets monthly.

A total of 418 specimens have been collected since October, 1970. Duplicates of some species were made for use in the Unit Council's education programs. The Mountaineers Unit #81 donated funds for two herbarium portfolios. A donation from Unit #29 in memory of Dorothy Schwager funded three folding display units which are used for educational displays at functions of the Arboretum Foundation and Unit Council.

The volunteers of the Herbarium Committee are not taxonomists, but they are more interested in the technical aspects of plants than the average gardener. Through their efforts on this committee they are learning fascinating secrets of plant growth and development. At the same time the committee is striving to fill a niche in public understanding of the Arboretum and its educational virtues. This commitment can be met more fully when the long-anticipated new administration office on the Arboretum grounds, with space for the herbarium, becomes a reality. In the meantime the herbarium collection is growing. . . .

ARBORETUM WEATHER 1973

	Precipitation		*Temperature (F°)*	
		20-year		
	Inches	*Average*	*Maximum*	*Minimum*
Jan	5.52	6.59	55	10
Feb	2.47	4.30	63	26
Mar	2.14	3.90	65	32
Apr	1.25	2.84	70	30
May	1.45	1.78	94	36
June	2.90	1.69	90	38
July	0.32	0.74	90	44
Aug	0.77	1.26	84	44
Sep	1.73	2.07	88	40
Oct	3.00	3.31	69	38
Nov	8.58	6.21	58	26
Dec	9.62	6.64	52	30
Total	39.75	41.33		

Days with maximum below 32° - 3 Days with minimum below 32° - 43 Days with minimum below 20° - 6

1973 was not an especially severe year weatherwise. Except for the first 10 or so days in January when we had 3 days with maximums below freezing and 6 days with minimums below 20°, temperatures were nearly normal, perhaps even slightly above normal. Rainfall was low during the first six months when it was 5.37 inches below the 20-year average but picked up in the latter part of the year. November and December were really wet, 18.18 inches total for the two months. This brought the yearly total to within 1.58 inches of the 20-year average.

UNIT CONVERSATIONS

Seattle and its suburbs will be a riot of color this spring with the 45,000 bulbs that were sold this fall at the Arboretum Unit Council Bulb Sale. This third annual sale was again chairmaned by our untiring and peppy "gardener" Jeanne Gardiner (Mrs. Arthur P.). This bulb sale which has mushroomed from 200 customers the first year, 1971 to 350 customers in 1972, to over 800 people this fall of 1973, started with Jeanne's own Arboretum Unit #41. These women fell in love with the hardy cyclamen so Jeanne started out to find them in wholesale quantities for the group—she did! The Arboretum Foundation is now a familiar customer of local bulb growers as well as Eastern United States and the famous Holland bulb growers. Unit #41, the year they ordered their own bulbs, donated $100 to the Arboretum. The first year Jeanne chairmaned the bulb sale they made a profit of $1,300 for the Arboretum, in 1972 the bulb sale profited $1,600—this year 1973 the profit is around $3,200!

Jeanne is so knowledgeable about her bulbs that she is constantly being called upon for planting and other related horticultural information. She will go next spring to consult in the planting of bulbs around our state capitol building in Olympia. She says she has made many new friends as customers. She has acquired eighteen new members for the Arboretum Foundation, three of whom joined units. Three of these new members are men who seem anxious to belong to a men's unit of the Unit Council. Our bulbs were taken to England as a hostess gift, *Trillium luteum* was shipped to Wisconsin and Jeanne herself planted bulbs below normal depth in Deer Park, Wa., where in 1969 it got below 43°F.

The Bulb Sale has specialized in Western and Eastern natives for our local gardens. One of the new and unusual pretty perennials sold this year was the *Caulophyllum thalictroides*, commonly called "Blue cohosh." It likes a shady wooded garden, needs rich soil and has a green purple flower in the spring and a metallic blue berry later. It harmonizes well with trilliums.

Several people ordered Kansas Cattail Gay-feather, *Liatris pysnostachya* out of nostaliga for their home state. This perennial sends up a rosy purple flower in July and grows from three to five feet tall and will survive in poor soil.

The Arboretum Unit Council gives a BIG THANKS to Jeanne Gardiner for a most successful Bulb Sale.

The Unit Council offers many varied services to the public. A very gracious Eastside donor offered his five year old rhododendron seedlings to the Arboretum. Through the School Program grapevine, Doris Taggart (Mrs. Raymond) knew of a proposed planned Arboretum at Juanita Elementary School in the Lake Washington School District. On a very wet day this fall a teacher, a School P.T.A. member and two Unit Council members, Doris and Marlynn Kolesar (Mrs. Richard) and one child from each of the classrooms in this grade school, met in the new Arboretum area. Marlynn gave the children an interesting talk on rhododendrons, showing them the difference in the large and small leaved plants, the different kinds of environments that they each like; she showed them seed pods and what the bud looked like. Then they demonstrated how to plant the seedlings and how to group them naturally in this lovely stand of Douglas Fir, which had been prepared in advance for these plantings. Through these very dedicated Arboretum Unit Council members, an environmental teacher, an interested mother, a staunch principal and a generous rhododendron grower and willing, learning children—the Juanita Elementary

School Arboretum has a start. The Arboretum will be dedicated in a few weeks and all Arboretum Foundation members are invited to view this new project.

Thinking of our retired senior citizens, the Indoor Plant Study Group and other interested Unit Council Board members, led by Nancy Hewitt (Mrs. David M.), visited Northhaven Retirement Home on November 20th. Armed with soil, pots, plants, trowels and lots of friendly garden conversation they conducted an informal indoor plant clinic. The residents were given a short talk on how to care for their plants, how to divide, and how to make them survive. The group took many plants to share and some to sell nominally, so that all who attended could have some living plants to brighten their rooms. It was a fun day for all!

"HOLIDAY PLANT GALA," Unit 10's successful money raising activity to benefit the Arboretum this year, was held December 12th at the home of Mrs. Seth Richards, for unit members and their guests. A brunch was followed by a silent auction of indoor plants for self or holiday gift-giving, including plants ranging from the fascinating tiny "wood nymph" to the large exotic figs, palms and Australian Silk, oak, plus varieties of ferns and unusual flowering house plants. Also for sale were house plant accessories such as fertilizers, misters, etc.; floral note paper, beautifully printed by a local resident; and a collection of indoor gardening books. Some of the most appealing books were *COOKING WITH FLOWERS* by Zack Haorle, *AFTER DINNER GARDENING BOOK* by Richard Long, *MAKING THINGS GROW* by Thalassa Cruso, the Brooklyn Botanical House Plant publications, *FLOWERING HOUSE PLANTS MONTH BY MONTH* by Jack Kramer, *HOUSE PLANTS IN COLOR* by Stark and Link. This interesting money-making project could be adapted by many of our Units.

PHYLLIS MORGAN

Book Reviews

INDIAN USES OF NATIVE PLANTS, by Edith Van Allen Murphey. Mendocino County Historical Society, 243 Bush St., Fort Bragg, Calif. 98437. Copyright 1959. Third Printing. 81 pp. $2.50.

This extensive information about the culture and customs of the Indians in the Rocky Mountain area relative to plants, was developed as a side-line of work done at the Nevada Indian Agency on stock poisoning plants. Over a period of ten years tribes were contacted, mostly in Nevada but also in Montana, Wyoming, Idaho, Utah, California and Oregon. The Shoshones were especially plant conscious, had studied plant families and had a rough botany of their own. Migrations yielded plants from several botanical zones and seasonal variations were also well known to the Indians.

It was not easy to secure information from the Indians themselves on their names and uses of the plants "but when it was made plain that it was desirable that the knowledge possessed by them should not be lost, but made a matter of record they cooperated willingly and proudly . . . " Botanical identifications were obtained from the state universities nearest the reservations and due acknowledgment is made to six of them, especially Oregon State College. The author was able to send pressed specimens to the universities to add to their herbariums, frequently from areas never before cruised by botanists.

There are chapters on Basketry, Indian Foods, Famine Foods, Beverages, Feasts, Greens, Meats, Nuts, Seeds, The Salt Journey (an interesting account of a seasonal migration), Medicinal Plants, Ceremonials and Magic, Bows and Arrows, Dye Plants, Tanning Hides, Odds and Ends, Hair, Tepees, Tobacco and at the end an extensive Dictionary of Plant Names—Common, Indian and Botanical.

Basketry, "an ancient art," was highly developed in this area, with extensive use of whatever plants were available in the various regions. Baskets were of endless sizes, shapes and uses. Some of the plants used were Silver Willow, Wild Rose, Red Bud, Grapevine, Hazel, Osier Dogwood, maple, honeysuckle, Indian Hemp, Bear Grass, sedges, native milkweeks, cedar bark, a giant Woodwardia Fern and roots of digger pine, spruce, fir and nutmeg. Preparation of the dyes was elaborate and must have required much experimentation. When necessary, mordants were used, either other plants or minerals. Designs could be elaborate, such as Wild Geese flying in a V.

Preparation of foods frequently included the cooking and roasting of roots *(Lewisia rediviva)* and bulbs *(Camas)*. (Poisonous plants are not stressed, unfortunately.)

Medicinal use of plants was extensive and seems to indicate that there was much disease of all kinds. A crude "Penicillin" was obtained from damp acorns and used on boils and sores.

A number of plant leaves were used as tobacco. "Kinni-Kinnick" originally referred to a tobacco mixture composed of leaves from several shrubs

in addition to the Bear Berry, our Kinnikinnick.

The front and back covers of this little paperback include an artistic Indian calendar from Warm Springs, Oregon (January—'Snow Moon,' October—'Moon of Plenty Food') and an animated map of Utah made by Indian students in 1944.

MAY GUY

TRAVELLER IN A VANISHED LANDSCAPE; THE LIFE AND TIMES OF DAVID DOUGLAS, BOTANICAL EXPLORER. Morwood, William. New York, Clarkson N. Potter, Inc., 1973. 231 pp. $7.95.

"Inside David Douglas" might well be the title of William Morwood's new biography of the great plant discoverer, David Douglas. Mr. Morwood's book relates the story of Douglas the anti-hero, and even weaves in an imagined liason with an Indian Princess, based on the dates of several trips made, according to his Diary, to visit his Indian friend, Chief Clocqua of the Chehalis Chinook tribe. No mention of a meeting or even of the existence of the Indian maiden has ever been found, despite the fact that Douglas kept his Diary faithfully, and that he had many friends among the Hudson's Bay Fur Company administrators who surely would have made some reference to this part of Douglas's life, were the events Morwood relates true.

Apparently the author believes that the rather vascillating personality which he describes IS the real David Douglas. One wonders how this great man, who travelled by foot, horseback, or canoe more than 12,000 miles in the western wilderness, who discovered seven of the seventeen pine species, and for whom more plant species have been names than any other person in the history of botany, ever had time to collect the staggering number of plants, seeds, and specimens which he did, if he had been the indecisive man pictured in the book.

Features of the book include a nine-page bibliography, attesting the diligence of the author, and several maps which show Douglas's routes on the west coast. The map of his California travels is particularly enlightening and somewhat surprising, since one ordinarily thinks of Douglas largely as the discoverer of Pacific Northwest species. Among the illustrations are a number of handsome line drawings of some of the beautiful plants which Douglas collected, and Douglas's portrait as the frontispiece.

BERNICE FERRIER SMITH
Assoc. Director, Weter Memorial Library
Seattle Pacific College

WILDFLOWERS OF THE OLYMPICS: 100 Wildflowers of Olympic National Park, by Charles Stewart. Nature Education Enterprises, P. O. Box 27103, San Francisco, Calif. 94127. In cooperation with the Olympic Natural History Association, Port Angeles, Washington, 1972. $2.95.

The 100 different species of wildflowers described in this paperback booklet are those most commonly seen, out of over 1000 species and varieties in the park. They are essentially the same list as depicted and described in the booklet "101 Wildflowers of Olympic National Park" by Grant and Wenonah Sharpe. (This was also published in cooperation with the Olympic Natural History Association, in 1954, 1957 and 1963. Price $1.00.)

This booklet has the advantage of colored photographs which are mostly by the author. It is a beautiful little booklet.

The elevational zones are named somewhat differently than usual, as Lowland Forest, Montaine Forest, Subalpine, Arctic-Alpine. Common names, scientific names and the meaning of the latter are all given, as well as geographic, climatic and zonal locations of the plants.

Eight species of Olympic flowering plants are endemic to the peninsula, that is, they are found only in the Olympic Mountains. These plants are thought to be "relics" of a former ice age, surviving above the level of the glacier, hence are all in the Arctic-Alpine Zone. Three of the eight are included here. They are Pipe Bellflower *(Campanula piperi)*, Flett Violet *(Viola flettii)*, Mt. Wallflower *(Erysimum arenicola)*. Otherwise the flora is similar to that of the Cascade Mountains and thus can be used as a handbook for both ranges.

MAY GUY

SUPPORT
YOUR ADVERTISERS

SAXE FLORAL

A bit different

A bit better

2402 N. E. 65th, Seattle 98115

523-4415 523-3646

R. DAVID ADAMS

European Garden Shop

220 First Ave. S.
Pioneer Square Area
622-5325

Italian Terra Cotta Showroom
Cut Flowers & Greenery
Garden Accessories for Patio,
Lanai, Solarium & Atrium

C. D. SCHWARTZE
GARDEN & NURSERY

2302 Tacoma Road
Puyallup, Wa. 98371
845-6018

Choice ornamental crabapples.
New, better apples.
Dwarf, semidwarf and full-size trees.
Bare-root trees November-April.
Trees in tubs any time.

Descriptive catalog on request.

Covent Garden

PIER 70, SEATTLE, WA. 98121 MA 4-1966

FEATURING UNIQUE PLANTINGS, TOOLS, CONTAINERS & DECOR ITEMS

For GIFTS and FLOWERS
of Unmistakable Distinction

Crissey
FLOWERS · GIFTS

1329 Fifth Avenue **MAin 2-1100**

MsK nursery

Variety for the Garden
Natives and Exotics
Botanical Note Cards

Mareen S. Kruckeberg
20066 15th N.W. 546·1281

CHOICE and UNUSUAL
Trees — Shrubs — Vines
Garden Accessories
TROPICAL INDOOR PLANTS
Largest & Finest Selection
In the Entire Northwest
Cut Flowers
Potted Plants and Gifts
COMPLETE FLORAL SERVICE

LAND OF FLOWERS
9701 - 15th N.W. — Phone SU 2-2544
Producers of Fine Plants Since 1888

for excellence in
NURSING OR BOARDING CARE
ISSAQUAH VILLA — EX 2-5351
VALLEY VILLA — BA 6-7500
Medicare Approved
— — — — — — — —
MARYCREST VILLA — EA 9-5500
Adult Residential Care
facilities of Villa Care, Inc.
Wash. State Licenses 475, 210, 569

ENGLISH IMPORTED AURICULAS
POLYANTHUS • SPECIES
PACIFIC HYBRID DELPHINIUMS
EXBURY AZALEAS • PERENIALS
DWF. GERANIUMS
BONSAI MATERIALS
Primrose Acres
Between Kenmore and Juanita on 84th Ave. N.E.
(Turn E. off Juanita Dr. on N.E. 141st,
drive 1 mile to 84th)
VA 2-6176
MRS. L. G. TAIT
14015 - 84th Ave. N.E.
BOTHELL, WASHINGTON

Bunge Lumber & Hardware Co.
High Grade Peat Moss and
All Types of Fertilizer
Including
Acid Fertilizer for Rhododendrons, Azaleas, Camellias, etc.
WEst 2-0022
9616 16th Avenue S.W., Seattle 98116

MEMBERSHIP APPLICATION

The Arboretum Foundation
University of Washington Arboretum
Seattle, Washington 98195

I hereby apply for membership in the Arboretum Foundation. Remittance, in the category checked below, is enclosed to cover dues for the next twelve months.

☐ Life	$500.00
☐ Sponsor	$100.00 to $500.00
☐ Supporting	$50.00
☐ Contributing	$25.00
☐ Sustaining	$10.00
☐ Annual	$5.00
☐ Group Affiliation (Garden Club, etc.)	$10.00 or more

☐ I am also interested in belonging to a Unit

Name _____ Phone _____

Address _____

City _____ State _____ Zip _____

Membership dues are deductible from income tax

LIMITED PRINTS are beautiful 11" x 15" original size, full color, numbered, reproductions of Rhododendron yakusimanum and Rhododendron 'Crest'. Each print will be registered and guaranteed with the Publisher. There were approximately five hundred printed and when these are sold they will not be reprinted as the plates have been destroyed. The beauty of the flower and Mr. Greenwood's artistry make these worth framing and displaying.

"RHODO" NOTES are regular note size, full color, reductions of these LIMITED PRINTS. Twelve charming notes (6 of each variety) are supplied with envelopes in a useful plastic container. They are ideal gifts for all occassions and you will use them youself.

This is the first offering ever made. For your convenience, an order blank is furnished on the opposite side of this note.

PUGET PRINTS
3431 Broadway • Everett, Wa. 98201

PUGET PRINTS
3431 Broadway • Everett, Wa. 98201
Phone 206/259-9148 • Seattle 622-0805

Please send me:

____ packages "Rhodo" Notes @ $2.50/pkg. of 12 .____

____ Rh. yakusimanium Limited Prints @ $10.00 ea. ____

____ Rh. 'Crest' Limited Prints @ $10.00 ea. . . .____

Sub Total ____

5% Sales Tax ____
(Washington residents)

Postage & Handling
if Sub Total under $10 $1.00

TOTAL ENCLOSED ____

Mail to: ____
NAME

____
ADDRESS

____
CITY STATE ZIP

PUGET PRINTS
3431 Broadway
Everett, Wa. 98201

to give a plant-lover

Flora of the Pacific Northwest

An Illustrated Manual

C. Leo Hitchcock and
Arthur Cronquist
Illustrations by **Jeanne R. Janish**

Botanists, gardeners—amateur, professional, or student—and all devoted plant-lovers will find this their one indispensable volume.

Flora is a taxonomic treatment of all species of flowering plants, conifers, ferns, and fern-related plants native to or established in Washington, northern Oregon and Idaho, western Montana, and southern British Columbia.

Flora has a unique format, with several thousand superb illustrations set in the margin alongside the corresponding description. There is a complete glossary, an index to all Latin and common names employed, and two copies of the list of abbreviations and signs used—one included as a loose sheet for quick reference.

So give a plant-lover a book.
The most helpful and easy-to-use work of its kind.
Flora of the Pacific Northwest.
$25.00 from all better bookstores or

The University of Washington Press Seattle 98195

THE ARBORETUM BULLETIN

Published by the
Arboretum Foundation
University of Washington Arboretum
Seattle, Washington 98195

ADDRESS CORRECTION REQUESTED

NON-PROFIT ORG.
U. S. POSTAGE PAID
SEATTLE, WASHINGTON
Permit No. 126

UNIVERSITY OF WASHINGTON

ARBORETUM FOUNDATION

announces

availability of past BULLETINS

at 50c per copy

In limited numbers: copies from 1936, 1937, 1938, 1940, 1941, 1942, 1943, 1944, 1945, 1946.

In greater supply with a few exceptions are BULLETINS from 1947 to the present time.

The impending building renovations involving storage space for these BULLETINS make immediate action urgent. This is an excellent opportunity to procure back copies. Orders will be filled on a first come-first served basis.

Please direct your orders to:

ARBORETUM FOUNDATION,

MRS. MARILYNN HOLM, Executive Secretary

325-4510 University of Washington, Seattle, Washington 98195